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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/668,668	09/23/2003	Anacleto M. de Figueredo	1021.2003-001	1053
21005 7590 01/17/2008 HAMILTON, BROOK, SMITH & REYNOLDS, P.C. 530 VIRGINIA ROAD P.O. BOX 9133 CONCORD, MA 01742-9133			EXAMINER YANG, JIE	
			ART UNIT 1793	PAPER NUMBER
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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

<b>Office Action Summary</b>	Application No. 10/668,668	Applicant(s) DE FIGUEREDO ET AL.	
	Examiner Jie Yang	Art Unit 1793	

**– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –**  
**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

#### Status

- 1) ☒ Responsive to communication(s) filed on 05 November 2007.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

#### Disposition of Claims

- 4) ☒ Claim(s) 31-65 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 31-65 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

#### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

#### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All    b) ☐ Some \*    c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

#### Attachment(s)

- |  |   |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892)                                | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)                       | 5) <input type="checkbox"/> Notice of Informal Patent Application                       |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08)<br>Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 11/05/2007 has been entered.

### ***Status of the Claims***

Claims 1-21, and 23-30 are canceled; claims 31-65 are added; and claims 31-65 are pending.

### ***Status of the Previous Rejections***

Previous rejections of Claims are withdrawn in view of the applicant's amendment to the claims:

Claims 1, 4, 7, 8, 10, 14, 16, 18-21 and 28-30 under 35 U.S.C. 103 (a) as being unpatentable over Flemings et al (US 6,645,323, thereafter US'323) in view of Winterbottom et al (US 6,742,567, thereafter US'567).

Claims 2, 3, 5, 11, 12, and 15 under 35 U.S.C. 103 (a) as being unpatentable over US'323 in view of US'567 as applied to claim 1, and further in view of Adachi et al (US 5,701,942, thereafter US'942).

Claims 5 and 6 under 35 U.S.C. 103 (a) as being unpatentable over US'323 in view of US'567 as applied to claim 1, and further in view of Moschini (US 5,464,053, thereafter US'053).

Claim 9 under 35 U.S.C. 103 (a) as being unpatentable over US'323 in view of US'567 as applied to claim 1, and further in view of Martinez et al ("Efficient Formation of Structure Suitable for Semi-Solid Forming", Transactions 21<sup>st</sup> international Die Casting Congress & Exposition, Oc.29-Nov.1, 2001).

Claim 13 as being unpatentable over US'323 in view of US'567 and US'942 as applied to claim 11, and further in view of the ASM Metals Handbook, 9<sup>th</sup> edition, Vol.15, Casting.

Claim 17 under 35 U.S.C. 103 (a) as being unpatentable over US'323 in view of US'567 as applied to claim 1, and further in view of US'053 and DasGupta (US 6,908,590, thereafter US'590).

Claims 23-27 under 35 U.S.C. 103 (a) as being unpatentable over Adachi et al (EP 0 745 694, thereafter EP'694) in view of US'567.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 31-42, 44-49, 52-57, 60, 61, and 64-65 are rejected under 35

U.S.C. 103(a) as being unpatentable over Adachi et al (EP 0 745 694, thereafter EP'694).

Regarding claims 31, EP'694 teaches a method and apparatus for the semisolid forming of alloys with fine-grained spherical structure in a convenient, easy and inexpensive manner (Abstract of EP'694). Regarding steps a, b, d, and e, EP'694 teaches a liquid alloy having crystal nuclei at a temperature not lower than the liquidus temperature or a partially solid, partially liquid alloy having crystal nuclei at a temperature not lower than a molding temperature is fed into an insulated vessel (reactor-noted by examiner) and it is cooled to the molding temperature where a specified fraction liquid is established (Abstract, summary, and claim 1 of EP'694). Regarding step c and still regarding steps b and e, EP'694 teaches two or more liquid alloys having different melting points are heated above the liquidus, then mixed either directly within an insulated vessel having a heat insulating effect or along a trough in a channel

into the insulated vessel to generate crystal nuclei in the alloy solution (Example 13 and Fig. 70 of EP'694).

EP'694 does not specify the plurality of intersecting inner channels (in steps b) and mixing via fluid impingement and convection (in steps c and e). However, EP'694 teaches using more than one jigs or channels and teaches mixing the alloys in the channel (Example 13 and Fig. 70 of EP'694). Therefore, it would have been obvious to one skilled in the art at the time the invention was made to connect different channels for intersecting inner channels and use these intersecting inner channels according the teaching of EP'694 in order to mix fluid of alloys in the channels. EP'694 teaches making the same semisolid alloy through the similar heating, molding and cooling process through channels as the instant invention, the mixing via fluid impingement and convection would be inherent present. See MPEP 2112 III&IV.

Regarding claims 32-34, EP'694 teaches different ladles (melt inlets) connect with different jigs (or channels) to lead alloys into vessel (reactors) as shown in Fig. 70 and examples 1 and 13. EP'694 teaches using more than one jigs or channels for two or more alloys and teaches mixing the alloys in the channel (Example 13 and Fig. 70 of EP'694) as discussed in claim 31.

Therefore, it would have been obvious to one skilled in the art at the time the invention was made to use more than one melt inlets, for example, use two melt inlets; connect with different inner channels; and intersect between 1<sup>st</sup> and 2<sup>nd</sup> inner channels as claimed in the instant claim 32; add 3<sup>rd</sup> and 4<sup>th</sup> inner channel and intersect at 1<sup>st</sup> junction as claimed in the instant claim 33; or intersect 3<sup>rd</sup> and 4<sup>th</sup> inner channels at second junction as claimed in the instant claim 34 in the process of EP'694 because EP'694 discloses the same utility throughout the disclosed ranges.

Regarding claims 35, 44, EP'694 teaches mixture of alloys is cooled to the molding temperature where a specified fraction liquid is established (Abstract, summary, and claim 1 of EP'694). The molding temperature is below a solidus temperature of the semi-solid metal alloy as recited in the instant claims (Examples 1 and 13 of EP'694).

Regarding claims 36-37, cooling rate is recognized as a results-effective variable in term of crystalline status. EP'694 teaches the temperature and the velocity of the circulating hot air are controlled such that the molten metal will be cooled at a desired rate (Examples 6-7 of EP'694). Therefore, it would have been obvious to one ordinary skilled in the art at the time

the invention was made to optimize the cooling rate, for example at least 15°C/sec as claimed in the instant claim 36 or about 20 to about 30°C/sec as claimed in the instant claim 37 in order to obtain semisolid forming of alloys with fine-grained spherical structure (Abstract of EP'694). See MPEP 2144.05 II.

Regarding claim 38, EP'694 teaches semi-solid alloys, for example Al-B-Ti, Mg-Sr, Mg-Si-Sr, Al-Si-P, Al-Si-P-Sr, and Al-Mg-Si (Claims 7, 8, 32, and 33 of EP'694), which reads on the claimed alloy includes at least one of the materials selected from the group consisting of aluminum, lead, tin, magnesium, manganese, strontium, titanium, silicon, iron, carbon, copper, gold, silver, and zinc as claimed in the instant claim.

Regarding claims 39 and 40, EP'694 teaches a method and apparatus for the semisolid forming of alloys with fine-grained, spherical thixotropic structure in a convenient, easy and inexpensive manner (Abstract of EP'694), which reads on the semi-solid metal alloy in at least one application selected from the group consisting of thicasting applications and rheocasting applications as claimed in the instant claim 39, and reads on the limitation of substantially free of dendrites as claimed in the instant claim 40 (also refer to Examples 1-13 and Fig.4, 7, 13, 35, 57 and 72 of EP'694).



Regarding claims 41 and 42, EP'694 teaches the semi-solid metal alloy includes the average primary particle size from 40 micron to 140 micron (Table 6 and 7 of EP'694), which overlaps the primary particle size range of 100 micron or less as claimed in the instant claim 41 and the primary particle size range of 70 micron or less as claimed in the instant claim 42.

Regarding claims 45-47, EP'694 teaches an alloy with crystal grain size 50 $\mu$ m resulting from using a Ti-B grain refiner as claimed in the instant claims and water quenching (Col.11, lines 35-40 and Fig.15 of EP'694).

Regarding claims 48 and 49, EP'694 teaches liquid alloy having crystal nuclei that has been superheated by less than 10°C above the liquidus line, which reads on the limitation of at least about 5 °C above the liquidus temperature as recited in the instant claim 48 and close enough to the limitation of the range of between about 10°C to about 15°C above the liquidus temperature as claimed in the instant claim 49. See MPEP 2144.05 II.

Regarding claim 52, EP'694 teaches the semisolid alloy is fed into a forming mold, where it is shaped under pressure, which reads on the limitation of directing the semi-solid metal

alloy to a metal-forming process as recited in the instant claim.

Regarding claims 53 and 54, EP'694 teaches the fraction liquid in the alloy to be shaped is preferably controlled to lie between 20 % to 90%. More preferably, the fraction liquid should be adjusted to range between 30% to 70% in order to ensure that shaped parts of high quality can easily be produced by pressure forming (Page 49, lines 8-15 of EP'694). Above fraction liquid range overlaps the volume fraction of solid of at least about 30% as recited in the instant claim 53, and the volume fraction of solid of from about 40% to 60% as recited in the instant claim 54.

Regarding claim 55, EP'694 teaches a semi-solid metal alloy with fine-grained spherical structure (Abstract of EP'694, and refer to the rejection for the claim 31).

Regarding claim 56, which includes limitations of claim 31 steps a, b, and c and the limitations of claims 32-34, please refer to the rejections for claims 31-34, claim 56 renders obvious over EP'694.

Regarding claim 57, which depends on claim 56 and includes same limitation of claim 35, refer to the rejections for the claim 56 and claim 35, claim 57 renders obvious over EP'694.

Regarding claim 60, EP'694 teaches using more than one jigs or channels for two or more alloys and teaches mixing the alloys in the channel (Example 13 and Fig. 70 of EP'694). EP'694 provides example wherein two or more liquid alloys having different melting points are heated above the liquidus, then mixing either directly or within an insulated vessel having a heat insulating effect to generate crystal nuclei in the alloy solution. The alloy resulting from mixing MA and MB is designated MC, and mixing is such that the resulting temperature is above the liquidus of MC (i.e. superheated). Crystal nuclei generated grow into non-dendritic primary crystal (Pages 48-51 of EP'694). The other limitations in the instant claim 60 are same as the limitations recited in the instant claim 31. Refer to the rejection for the claim 31, claim 60 renders obvious over EP'694.

Regarding claim 61, which depends on claim 60 and includes the similar limitations as claims 32-34, refer to the rejections for the claim 60 and claims 32-34, Claim 61 renders obvious over EP'694.

Regarding claim 64, which depend on claim 60 and include the limitation of claim 35, refer to the rejections for the claim 60 and claim 35. Claim 64 renders obvious over EP'694.

Regarding claim 65, which depend on claim 60 and include the limitation of claim 55, refer to the rejections for claim the 60 and claim 55, claim 64 renders obvious over EP'694.

Claim 43 is rejected under 35 U.S.C. 103 (a) as being unpatentable over EP'694 in view of Martinez et al (NPL: "Efficient Formation of Structure Suitable for Semi-Solid Forming", Transactions 21<sup>st</sup> international Die Casting Congress& Exposition, Oc.29-Nov.1, 2001, thereafter NPL-1).

EP'694 does not specify that the shape factor is in the range of about 0.75 to 0.95. NPL-1 teaches the results of testing the effect of varying stirring time and speed (rpm) upon shape factors (Abstract, P.47 of NPL-1), wherein each of the stirring time and speed were varied (pp.48-49 of NPL-1). The results indicate that shape factors of between 0.75 and 0.95 are received (Fig.8 and 9 of NPL-1) and that increasing stirring speed results in greater sphericity (Fig.9 and conclusion at p.49 of NPL-1). Stirring speed is therefore recognized as a result-effective variable in the art, which is varied to affect the sphericity and therefore the calculated shape factor of the grains of alloys produced in the semi-solid forming methods. It would have been obvious to one ordinary skill in the art at the time the invention was made to adjust the stirring speed as

taught by NPL-1 in the process of US'694 to achieve a shape factor in the range of 0.75 to 0.95 as disclosed by NPL-1. See MPEP 2144.05 II, B.

Claim 50 is rejected under 35 U.S.C. 103 (a) as being unpatentable over EP'694 in view of Winterbottom et al (US 6,742,567, thereafter US'567).

Regarding claim 50, EP'694 does not specify including the step of forming a billet from the semi-solid metal alloy. US'567 teaches a method of producing a semi-solid material without stirring, including heating the metal to form a melt, crystallizing by cooling at a controlled rate to produce a semi-solid material (Abstract of US'567). US'567 teaches forming a billet (Col.4, lines 45-60 of US'567). It would have been obvious to one of ordinary skill in the art at the time the invention was made to include the step of forming a billet from the semi-solid metal alloy as demonstrated by US'567 in the process of EP'694 because US'567 discloses equal utility over the entire range (forming a billet from the semi-solid metal alloy). SEE MPEP 2144.05 I.

Claim 51 is rejected under 35 U.S.C. 103 (a) as being unpatentable over EP'694 as applied to claim 31, and further in view of DasGupta (US 6,908,590, thereafter US'590).

EP' 694 is applied as described above regarding claim 31.

EP' 694 does not specify recycling the metal alloy from the forming process as in the instant claim 51.

US' 590 teaches that an economic advantage of rheocasting over thixocasting is that the scrap metal from forming can be recycled in the rheocasting process (Col.2, lines 4-15 of US' 590). It would have been obvious to one of ordinary skill in the art at the time the invention was made to recycle scrap as taught by US' 590 in the process of EP' 694 to benefit from the cost saving as taught by US' 590.

Claims 58-59, and 62-63 are rejected under 35 U.S.C. 103 (a) as being unpatentable over EP'694 as applied to claim 56, and further in view of Lantz (US 5,520,460, thereafter US'460).

EP' 694 is applied as described above regarding claim 56.

Using a plurality of intersecting channels to perform static-mixing is a well known technique in the instant art, which is evidenced by US' 460. US' 460 teaches A typical static - mixing unit comprises a series of stationary, rigid, mixing

elements placed lengthwise in a conduit, to form a plurality of intersecting channels which split, rearrange and recombine one or more component fluid streams into smaller and smaller layers, until there is one homogeneous stream as an outlet stream (Col.1, lines 8-32 of US'460). US'460 further teaches generally, adjacent mixing elements are positioned 90° relative to each other (Col.1, lines 8-32 of US'460). As discussed in the rejection for claim 31, EP'694 teaches using more than one jigs or channels for two or more alloys and teaches mixing the alloys in the channel (Example 13 and Fig. 70 of EP'694) as discussed in claim 31. Therefore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to design the first inner channel and the second inner channel intersect at the first junction at an angle of about 90° as recited in the instant claim 58; or the third inner channel and the fourth inner channel intersect at the second junction at an angle of about 90° as recited in the instant claim 59.

Regarding claims 62 and 63, which depend on claim 60 and include the same limitations as the claims 58 and 59 separately, please refer to the rejection for the claim 60 and claims 58-59. Claims 62-63 render obvious over EP'694.

***Response to Arguments***

Applicant's arguments filed on 11/05/2007 with respect to new claims 31-65 according to amendment have been fully considered but are moot in view of the new ground(s) of rejection. See above.

***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jie Yang whose telephone number is 571-2701884. The examiner can normally be reached on IFP.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Roy King can be reached on 571-2721244. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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ROY KING  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 1700